PLEASE AMEND THE SPECIFICATION AS FOLLOWS:

Please delete the paragraph beginning at line 4 of page 8 and extending through line 6 of page 8.

Please amend the paragraph beginning at line 11 of page 11 as follows:

Referring next to Fig. 3, there is shown a schematic cross-sectional view of the ABS surface of a patterned synthetic exchange longitudinally biased GMR sensor whose structure and method of fabrication will be described herein. This structure is similar in many respects to the direct exchange configuration of Fig. 2, except for the antiparallel directions of the F2 and F1magnetic moments M2 (12), M1 (13). It is this configuration of Fig. 3 which, when properly designed and optimized in accord with the simulations of the present invention, constitutes the first embodiment of the present invention. The following dimensions and method of fabrication however, are not yet in accord with the present invention. As can be seen in Fig. 3, there is first formed an antiferromagnetic pinning layer (40), which can be a layer of antiferromagnetic material chosen from the group of such materials consisting of PtMn, IrMn, NiMn, PdPtMn and FeMn, but which is preferably a layer of PtMn formed to a thickness of 100 angstroms. On this layer is then formed a synthetic antiferromagnetic pinned layer (30), which is a trilayer comprising a first ferromagnetic layer (32), preferably a layer of CoFe formed to a thickness of approximately 15 angstroms, on which is formed a non-magnetic antiferromagnetically coupling layer (34), preferably a layer of Cu formed to a thickness

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of approximately 18 angstroms, on which is formed a second ferromagnetic layer (36), preferably a layer of CoFe formed to a thickness of approximately 20 angstroms. On the pinned layer is then formed a non-magnetic spacer layer (31), which is preferably a layer of Cu approximately 18 angstroms thick. On this spacer layer is then formed a ferromagnetic free layer (27), which is a bilayer comprising a CoFe layer of preferred thickness 10 angstroms, on which is formed an NiFe layer of preferred thickness 20 angstroms. The remaining layers deposited to complete the formation will not have their thicknesses specified at this point, since the preferred values of those thicknesses will depend on the application of the results of this invention and will be specified in conjunction with the discussion of Fig. 8, below. On the free layer is then formed a non-magnetic antiferromagnetically coupling layer (28), which can be a layer of either Rh or Ru of proper thickness to provide the antiferromagnetic exchange coupling with the biasing layer to be formed. On the coupling layer is formed a ferromagnetic biasing layer (25), preferably a layer of CoFe. On the ferromagnetic biasing layer is formed an antiferromagnetic pinning layer, preferably a layer of IrMn of approximately 40 angstroms thickness. Finally, a conducting lead layer (20) is formed on the pinning layer. At this stage of the fabrication two magnetic annealing processes are carried out, the first being to set the transverse magnetization of the pinned layer (30) and the second being to set the longitudinal magnetization of the free (27) and biasing (25) layers. Following these annealing processes, the physical trackwidth region (10) is formed by a sequence of etches and oxidation processes which leaves the conducting leads (20), the antiferromagnetic pinning layer (25) and the ferromagnetic biasing layer (25) in a patterned configuration. The first etching process is an ion beam etch, which removes the

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conducting lead layer (20) and the antiferromagnetic pinning layer (29) beneath it in the trackwidth region. A subsequent plasma etch then oxidizes the ferromagnetic biasing layer (25), destroying, thereby, its ferromagnetic properties within the trackwidth region, but leaving it physically present as a layer of oxide (45), which is shown unshaded. The physical trackwidth (10) of this configuration is approximately 0.1 microns and is defined by the width of the region between the leads (20) and patterned biasing (25) layers (F2). Because the ferromagnetic free layer (F1) (27) extends the entire width of the sensor, it is not adversely affected by the strength of the biasing layer as in the case of the hard biased abutted junction of Fig. 1. Unlike the configuration of Fig. 2, the free layer F1 (27) is separated from the biasing layer F2 (25) by a non-magnetic coupling layer (28) which is typically a layer of Cu, Rh or Ru and which has the correct thickness to exchange couple the ferromagnetic free layer (27) to the ferromagnetic biasing layer (25) by antiferromagnetic coupling. A layer of Ru of approximately 7.5 angstroms thickness, for example, is preferable. The remainder of this configuration is the same as in Fig. 2. The strength of the antiferromagnetic coupling (the pinning field) is stronger than the ferromagnetic coupling in Fig. 2 and is typically over 700 Oe. According to our simulations a physical trackwidth of 0.1 microns in the above configuration will produce an effective trackwidth of 0.15 microns because of the undesirable side reading. It is to be noted that the layer thicknesses given above refer to a prior art configuration as does the 0.15 micron effective trackwidth for a 0.1 micron physical trackwidth. Only with the use of the method of the present invention will the significant reduction in effective trackwidth and reduced side reading be obtained. The present invention will provide a

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novel mechanism for optimizing the thicknesses of F1 and F2 so as to appreciably narrow the effective trackwidth for a given physical trackwidth.

Please amend the paragraph beginning at line 16 of page 13 as follows:

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Referring next to Fig. 4, there is shown a schematic cross-sectional view of the ABS surface of a patterned synthetic exchange biased GMR sensor, whose novel configuration provides the second preferred embodiment of this invention. The configuration and its method of formation is similar in all respects to the patterned synthetic exchange configuration of Fig. 3, with the important difference that the biasing layer F2 (25) is not pinned by an antiferromagnetic layer (layer (29) in Fig. 3). The omission of the antiferromagnetic layer simplifies the fabrication process of the sensor, improves its topography and, most significantly, makes the magnetostriction characteristics negative. In the absence of the antiferromagnetic pinning layer the exchange energy term, J_{ex}, is zero and the optimization formula becomes:

$$M_{F2}/M_{F1}=(J_s+J_{ex})/J_s ==(J_s+0)/J_s =1,$$

which leads to an optimized thickness ratio, F_2/F_1, which is also 1. The F2 biasing layer (25) can be a layer of ferromagnetic material such as CoFe.

Please amend the following paragraph beginning at line 8 of page 18 as follows:

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Referring now to Fig. 8 there is shown the first preferred embodiment of this invention, which is the formation of the structure in Fig. 3, using the method of formation described in connection with the discussion of Fig. 3 and, in addition, applying the results of the simulations described in Fig's 5-7, Tables 1 and 2 and the formula $M_{F2}/M_{F1} = (J_s + J_{ex})/J_s$. In Fig. 8 there is shown, therefore, the structure of Fig. 3, wherein the dimensions of the F1 and F2 layers and their material composition are as follows. It is further understood that if the objects and advantages of the present invention are to be obtained, the determination of F2 and F1 dimensions must be calculated anew for each choice of their material composition and the values of J_s and J_{ex} resulting from the various possible coupling layers and pinning layers. In the present figure, however, the free layer (27) is a bilayer of CoFe/NiFe, wherein the CoFe (21) has a thickness between approximately 3 and 20 angstroms, with 10 angstroms being the preferred value and the NiFe (22) has a thickness between 40 and 10 angstroms, with 20 angstroms being the preferred value. Within this range of values, the biasing layer, F2, (27) is a layer of CoFe of thickness range between approximately 22 angstroms and 34 angstroms, with 28 angstroms being the preferred value and the non-magnetic coupling layer (28) is a layer of Ru of thickness between approximately 2 angstroms and 9 angstroms, with 7.5 angstroms being preferable. Alternatively, if the non-magnetic coupling layer (28) is a layer of Rh of thickness between approximately 3 and 6 angstroms, with 5 angstroms being preferable, the F2 layer (27) would be a layer of CoFe of thickness between approximately 18.6 angstroms and 26.6 angstroms, with 22.6 angstroms being preferable. The pinning layer of IrMn (29) is in the thickness range between approximately 25 angstroms and 100 angstroms. In the second embodiment, which would be the

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